SURGICAL SYSTEMS AND METHODS FOR IMPLANTING DEFLECTABLE IMPLANTS

FIELD OF THE INVENTION

The invention relates generally to implants, and more particularly to systems and methods for implanting deflectable implants.

BACKGROUND OF THE INVENTION

Minimally invasive subcutaneous procedures, which are performed through a small orifice in the skin, limit the size of the surgery tools and implants that are used.

Hence it would be highly advantageous to develop implants that have small cross sections such that they can be inserted easily through a small orifice in the skin and be deflected into their final functional expanded shape at the intended implantation site in the body.

It would be highly advantageous to provide implants for spinal surgeries such as interbody fusion, motion preservation and vertebral augmentation that may be inserted into the body in minimally invasive procedures.

SUMMARY OF THE INVENTION

Embodiments of the present invention disclose an implant comprising: (a) a base; and (b) a sequence of at least two segments including a first end segment and a second end segment, adjacent segments of the sequence being interconnected at a hinge, wherein the first end segment is interconnected with the base at a fixed hinge, and wherein the second end segment is interconnected with the base at a sliding interconnection, such that the base and the sequence of at least two segments assume an insertion state in which the sequence of segments is adjacent to the base, and a deployed state in which a part of the sequence of segments is deflected away from the base.

According to a further feature of certain embodiments of the present invention, in the deployed state, the base and the sequence of segments form a loop at least partially defining an enclosed volume.

According to a further feature of certain embodiments of the present invention, the sliding interconnection additionally allows pivotal movement of the second segment relative to the base.

According to a further feature of certain embodiments of the present invention, in the insertion state, the sliding interconnection is at a first position along the base, and wherein, in the deployed state, the sliding interconnection is displaced along the base from the first position towards the fixed hinge.

According to a further feature of certain embodiments of the present invention, the fixed hinge is located at one end of the base.

According to a further feature of certain embodiments of the present invention, the fixed hinge is located at a distal end of the base.

According to a further feature of certain embodiments of the present invention, the sliding interconnection includes an element slidingly engaged within a slot.

There is also provided according to the teachings of certain embodiments of the present invention, a method comprising the steps of: (a) providing the aforementioned implant; (b) introducing the implant in the insertion state into an intervertebral space; (c) deploying the implant to the deployed state; and (d) filling a space between the sequence of segments and the base with filler material to promote intervertebral fusion.

Additional features and advantages of the invention will become apparent from the following drawings and description.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, purely by way of example, to the accompanying drawings in which like numerals designate corresponding elements or sections throughout.

With specific reference now to the drawings in detail, it is stressed that the particulars shown are by way of example and for purposes of illustrative discussion of the preferred embodiments of the present invention only, and are presented in the cause of providing what is believed to be the most useful and readily understood description of the principles and conceptual aspects of the invention. In this regard, no attempt is made to show structural details of the invention in more detail than is necessary for a fundamental understanding of the invention, the description taken with the drawings making apparent to those skilled in the art how the several forms of the invention may be embodied in practice. In the accompanying drawings:

FIG. **1** illustrates an implant in a straightened state, according to embodiments of the present invention;

FIG. **2** illustrates the implant in a fully deflected state, according to embodiments of the present invention;

FIG. **3***a* illustrates an implant partially deployed, according to embodiments of the present invention;

FIG. **3***b* illustrates the implant partially deflected in the spine, according to embodiments of the present invention;

FIG. **3***c* illustrates the implant further deflected in the spine, according to embodiments of the present invention;

FIG. **3***d* illustrates the implant in its fully deflected state in the spine, according to embodiments of the present invention;

FIG. **4***a-c* illustrates an implant with fewer segments in straightened, partial and fully deflected states, according to embodiments of the present invention;

FIG. **4***d* illustrates the implant in its fully deflected state in the spine with a tension element used to fix the maximal width, according to embodiments of the present invention;

FIG. **5***a-c* illustrates an implant in straightened, partial and fully deflected states with final double ring shape, according to embodiments of the present invention;

FIGS. **6***a*(**1-2**) illustrate an implant with different number of segments in each side in a straightened and a fully deflected state, according to embodiments of the present invention;

FIGS. **6***b*(**1-3**) illustrate the implant deployment using a tension element, according to embodiments of the present invention;

FIGS. **6***c*(**1-3**) illustrate the implant deployment using an internal tensioning element, according to embodiments of the present invention;

FIG. **7***a* illustrates an elliptical shape implant in a straightened state, according to embodiments of the present invention;

FIGS. **7***b*(**1-3**) illustrate the elliptical implant in straightened, partially deflected and fully deflected states, according to embodiments of the present invention;

FIGS. **7***c*(**1-2**) illustrate the elliptical implant in straightened and fully deflected states with two internal tensioning elements, according to embodiments of the present invention;

FIG. **8** illustrates a D-shape implant in fully deflected states, according to embodiments of the present invention;